A6

means for combining the coarse displacement and the fine displacement to obtain the measure of the registration errors and chromatic aberration errors in the live video signals.

REMARKS

Claims 1, and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable in view of Topper et al. This ground for rejection is overcome by the filing of this application as Topper et al. is assigned to the same entity as the subject application and, therefore, is not prior art under 35 U.S.C. §102(e)(2).

Claims 4 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable in view of Topper et al. and the Digital Image Processing Article. This ground for rejection is also overcome by the filing of this application as Topper et al. is not prior art against this application under 35 U.S.C. § 102(e)(2).

Claims 1 and 9 were rejected under 35 U.S.C. § 103(a) as being unpatentable in view of White et al. This ground for rejection is overcome by amending claims 1 and 9 to recite that the chromatic aberration is corrected using live video images. White does not use live video images but uses a test pattern of white stripes on a black background (see col. 3, lines 37-53). Because White et al. do not disclose or suggest any circuitry that can correct chromatic aberration using live video images, claims 1 and 9 are not subject to rejection under 35 U.S.C. §103(a) in view of White et al.

Claims 4 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable in view of White et al. and the Digital Image Processing Article. This ground for rejection is also overcome by the amendments to claims 1 and 9 from which claims 4 and 12 depend, respectively. the Digital Image Processing Article does not provide the limitation that is missing from White et al. Accordingly, 4 and 12 are not subject to rejection under 35 U.S.C. § 103(a) in view of White et al. and the Digital Image Processing Article.

Claims 2, 3, 5-8. 10, 11 and 13-16 were objected to as being dependent from a rejected base claim. Because claims 1, 4, 9 and 12 from which these claims variously depend are no longer subject to rejection, these claims are no longer subject to objection.

In view of the foregoing amendments and remarks, Applicants request that the Examiner reconsider and withdraw the rejection of claims 1, 4, 9 and 12 and the objections to claims 2, 3, 5-8. 10, 11 and 13-16.

Respectfully Submitted,

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Dated: March 5, 2001

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The Assistant Commissioner for Patents is hereby authorized to charge payment to Deposit Account No. **18-0350** of any fees associated with this communication.

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3/5/01

Lynn S. Denitz

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Specification at page 1, after the title:

This application is a Continuation Application, claiming the benefit of U.S. Patent Application No. 08/857,912, filed May 16, 1997.

Specification at page 7, line 12:

As described below with reference to Figure 7, microprocessor 112 processes these stored pixel sets using a program stored in read only memory (ROM) 234 of the memory 114 and using a random access memory area 232 of the memory 114 to produce correction coefficients for the correction memory 116, shown in Figure 1 and to store coefficients and tally RAM images for the various lens conditions (e.g. zoom, focus and aperture settings).

Specification page 12, line 24:

The signal EDGE is applied to a second input terminal of the AND gate 411 and to the reset input terminal of a 32 pixel counter 420. The output signal of the AND gate 411 is applied to the set input terminal, S, of the flip flop 412 and the carry out signal of the 32 pixel counter 420 is applied to the reset input terminal of the flip-flop 412. Thus the flip-flop 412 is set when an edge is detected and reset when the counter 420 has counted 32 samples following that edge. The output signal of the flip flop 412, an inverted signal R SEL, and the output data provided by the tally RAM 224, shown in Figure 2, are applied to respective input terminals of an AND gate 414. The output signal of this AND gate is the video RAM write enable signal. This signal is also applied to an enable input terminal of the 32 pixel counter 420. The counter 420 is coupled to count pulses of the signal CLOCK when it is enabled. When the counter 420 reaches a value of 32, the carry out signal resets the flip-flop. The carry out signal is also applied to an AND gate 413 along with the output signal of the color balance circuitry. If the output signal of the balance counter is logic-high, then, when the carry out signal is pulsed, the AND gate 413 generates a signal NEW SAMPLE, indicating that a new set of samples has been written into the video RAMs 228 and 230 (shown in

Figure 2). ~~the~~ The signal NEW SAMPLE, increments the more significant bits of the address value applied to the video RAMs, so that the next sample set stored in a new location.

IN THE CLAIMS:

1. (Amended) A method for measuring registration errors and chromatic aberration in live video signals, said live video signals being represented as least first and second color signals and said registration errors and chromatic aberration appearing as misaligned edges of the first and second color signals in an image reproduced from the live video signals, the method comprising the steps of:

a) selecting a first set of N samples of the first color signal and a second set of N samples of the second color signal, where N is an integer greater than 2;

b) analyzing the first and second sets of N samples to determine if the respective first and second color signals are at proper relative levels to obtain valid information on misaligned transitions in the image;

~~b)~~ c)if the first and second color signals are at proper levels then analyzing the set of samples of the first color signal to determine whether the first set of samples contains M samples representing an edge in the image, where M is an integer less than N, and storing the first and second sets of samples if the first set of samples is determined to contain the M samples representing the edge; and

~~c)~~ d) comparing the stored first set of samples to the stored second set of samples to determine a displacement between the M samples in the first set of samples with M corresponding samples in the second set of samples.

2. (Amended) A method according to claim 1, wherein step ~~a)~~ b) further includes the steps of:

calculating a measure of color balance between the first set of samples and the second set of samples; and

discarding the first and second sets of samples if the measure of color balance has a value which is not within a predetermined range.

4. (Amended) A method according to claim 1, wherein M equals 2 and step ~~b)~~ c) includes the steps of:

calculating difference values between successive ones of the samples in the first set of samples;

comparing each of the calculated difference values to an edge threshold value; and

indicating that the set of samples represents an edge if any of the calculated difference values is greater than the edge threshold value.

5. (Amended) A method according to claim 1, wherein step ~~c)~~ d) includes the steps of:

performing a cross correlation between the stored first set of samples and the stored second set of samples to identify a coarse displacement between respective edges in the first and second sets of samples to a nearest intersample distance;

selecting the M samples from the stored first set of samples and M corresponding samples from the stored second set of samples, wherein each of the samples from the second set is displaced by the identified displacement from the respective sample in the first set;

interpolating S samples between successive ones of the M samples of each of the first and second sets of samples, where S is an integer;

performing a cross correlation between the respective M original and interpolated samples of the first and second sets of samples to identify a fine displacement between the first and second sets of samples which is less than one intersample distance of the original samples from a central sample of the M samples of the first set of samples; and

combining the coarse displacement and the fine displacement to obtain the measure of the registration errors and chromatic aberration errors in the live video signals.

6. (Amended) A method according to claim 1, wherein step ~~c)~~ d) includes the steps of:

performing a cross correlation between the stored first set of samples and the stored second set of samples to identify a coarse displacement between respective edges in the first and second sets of samples to a nearest intersample distance and storing a correlation value at each displacement considered in the cross correlation;

selecting at least three of the stored correlation values including the correlation value corresponding to the identified displacement;

fitting a parabolic curve to the selected correlation values;

determining a maximum point of the parabolic curve as a fine displacement; and

combining the coarse displacement and the fine displacement to obtain the measure of the registration errors and chromatic aberration errors in the live video signals.

7. (Amended) A method according to claim 1, wherein step ~~c)~~ d) includes the steps of:

generating respective measures of sum of absolute difference between the M samples of the first stored set of samples and M samples of the second stored set of samples for respectively different displacements between the first stored set of samples and the second stored set of samples;

identifying a coarse displacement as the sum of absolute difference measures which is less than or equal to any other one of the sum of absolute difference measures;

selecting the M samples from the stored first set of samples and M corresponding samples from the stored second set of samples, wherein each of the samples from the second set is displaced by the coarse displacement from the respective sample in the first set;

interpolating S samples between successive ones of the M samples of each of the first and second sets of samples, where S is an integer;

performing a cross correlation between the respective M original and S interpolated samples of the first and second sets of samples to identify a fine displacement between the first and second sets of samples which is less than one intersample distance of the original samples from a central sample of the M samples of the first set of samples; and

combining the coarse displacement and the fine displacement to obtain the measure of the registration errors and chromatic aberration errors in the live video signals.

8. (Amended) A method according to claim 1, wherein step ~~c)~~ d) includes the steps of:

generating respective measures of sum of absolute difference between the M samples of the first stored set of samples and M samples of the second stored set of samples for respectively different displacements between the first stored set of samples and the second stored set of samples;

identifying a coarse displacement as the sum of absolute difference measures which is less than or equal to any other one of the sum of absolute difference measures;

selecting at least three of the measures of sum of absolute difference including the measure corresponding to the coarse displacement;

fitting a parabolic curve to the selected measures;

determining a minimum point of the parabolic curve as a fractional intersample distance to be combined with the identified displacement to produce the measured displacement value.

9. (Amended) Apparatus for measuring registration errors and chromatic aberration in live video signals, said live video signals being represented as least first and second color signals and said registration errors and chromatic aberration appearing as misaligned edges of the first and second color signals in an image reproduced from the live video signals, the method comprising:

means for selecting a first set of N samples of the first color signal and a second set of N samples of the second color signal, where N is an integer greater than 2;

means for analyzing the first and second sets of N samples to determine if the respective first and second color signals are at proper relative levels to obtain valid information on misaligned transitions in the image;

a video memory;

means for analyzing the set of samples of the first color signal to determine whether the first set of samples contains M samples representing an edge in the image, where M is an integer less than N, and storing the first and second sets of samples in the video memory if the first set of samples is determined to contain the M samples representing the edge; and

means for comparing the stored first set of samples to the stored second set of samples to determine a displacement between the M samples in the first set of samples with M corresponding samples in the second set of samples.

10. (Amended) Apparatus according to claim 9, ~~wherein the means for selecting~~ means for analyzing the first and second sets of N samples to determine if the respective first and second color signals are at proper relative levels to obtain valid information on misaligned transitions in the image further includes:

means for calculating a measure of color balance between the first set of samples and the second set of samples; and

means for inhibiting the storage of the first and second sets of samples into the memory if the measure of color balance has a value which is not within a predetermined range.

13. (Amended) A method according to claim 9, wherein the means for comparing includes:

first correlation means for performing a cross correlation between the stored first set of samples and the stored second set of samples to identify a coarse displacement between respective edges in the first and second sets of samples to a nearest intersample distance;

means for selecting the M samples from the stored first set of samples and M corresponding samples from the stored second set of samples, wherein each of the samples from the second set is displaced by the identified displacement from the respective sample in the first set;

means for interpolating S samples between successive ones of the M samples of each of the first and second sets of samples, where S is an integer;

second correlation means for performing a cross correlation between the respective M original and S interpolated samples of the first and second sets of samples to identify a fine displacement between the first and second sets of samples which is less than one intersample distance of the original samples from a central sample of the M samples of the first set of samples; and

means for combining the coarse displacement and the fine displacement to obtain the measure of the registration errors and chromatic aberration errors in the live video signals.

14. (Amended) Apparatus according to claim 9, wherein the means for comparing includes:

means for performing a cross correlation between the stored first set of samples and the stored second set of samples to identify a coarse displacement between respective edges in the first and second sets of samples to a nearest intersample distance and storing a correlation value at each displacement considered in the cross correlation;

means for selecting at least three of the stored correlation values including the correlation value corresponding to the identified displacement;

means for fitting a parabolic curve to the selected correlation values;

means for determining a maximum point of the parabolic curve as a fine displacement; and

means for combining the coarse displacement and the fine displacement to obtain the measure of the registration errors and chromatic aberration errors in the live video signals.

15. (Amended) Apparatus according to claim 9, wherein the means for comparing includes:

means for generating respective measures of sum of absolute difference between the M samples of the first stored set of samples and M samples of the second stored set of samples for respectively different displacements between the first stored set of samples and the second stored set of samples;

means for identifying a coarse displacement as the sum of absolute difference measures which is less than or equal to any other one of the sum of absolute difference measures;

means for selecting the M samples from the stored first set of samples and M corresponding samples from the stored second set of samples, wherein each of the samples

from the second set is displaced by the coarse displacement from the respective sample in the first set;

means for interpolating S samples between successive ones of the M samples of each of the first and second sets of samples, where S is an integer;

means for performing a cross correlation between the M original and S interpolated samples of the first and second sets of samples, respectively, to identify a fine displacement between the first and second sets of samples which is less than one intersample distance of the original samples from a central sample of the M samples of the first set of samples; and

means for combining the coarse displacement and the fine displacement to obtain the measure of the registration errors and chromatic aberration errors in the live video signals.